

Chapter 4

Family Communication Letter (English).....	113
Family Communication Letter (Spanish).....	114
Section 4.1	115
Section 4.2	120
Section 4.3	125
Section 4.4	130
Section 4.5	135
Section 4.6	140
Section 4.7	145
Cumulative Review	150

Chapter 4

Writing Linear Functions

Dear Family,

Selling refreshments is an easy way for a club to make money at a school event. You or your student may have volunteered your time to work at a refreshment stand.

Suppose you are working at a school carnival. Because the peanuts were donated, all sales are profit. The cash box starts with \$30.00 for making change. You can figure out how much money should be in the cash box with a linear equation.

$$\text{Amount in cash box} = \text{Initial amount} + \left(\begin{array}{c} \text{Peanut price} \\ \text{(per pound)} \end{array} \right) \times \left(\begin{array}{c} \text{Peanuts sold} \\ \text{(in pounds)} \end{array} \right)$$

$$y = 30 + 2x$$

- Make a table of values. Find the value of y if x is 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, and 5.
- What do you notice about the slope of the line? What does the slope represent?

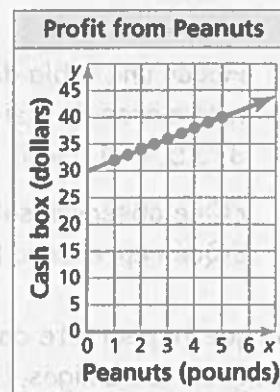
Suppose your parent gives you \$10 to spend on peanuts with a group of friends. The amount of money remaining depends on how many peanuts you and your friends have already purchased.

$$\text{Amount remaining} = \text{Initial amount} - \left(\begin{array}{c} \text{Peanuts price} \\ \text{(pound)} \end{array} \right) \times \left(\begin{array}{c} \text{Peanuts bought} \\ \text{(pound)} \end{array} \right)$$

$$y = 10 - 2x$$

- Make a table of values. Find the value of y if x is 0, 2.5, and 5.
- Graph your points on a coordinate plane. How is this graph different from the first graph? Explain.
- Explain what the points (0, 10) and (5, 0) represent.

Enjoy your peanuts!



Capítulo

4

Escribir funciones lineales

Estimada familia:

Vender refrescos es una manera fácil para que un club recaude dinero en un evento escolar. Usted o su hijo podrían haber ofrecido su tiempo para trabajar en el puesto de refrescos.

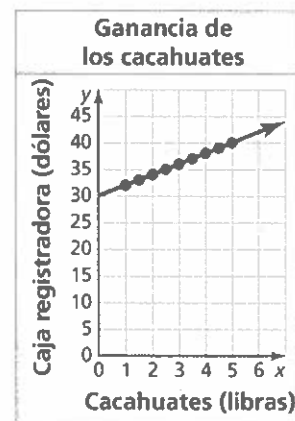
Supongan que están trabajando en una feria escolar. Como los cacahuates se donaron, todas las ventas son ganancia. La caja registradora comienza con \$30.00 para tener cambio. Pueden saber cuánto dinero debería haber en la caja registradora con una ecuación lineal.

$$\text{Cantidad en la caja registradora} = \text{Cantidad inicial} + \left(\begin{array}{c} \text{Precio de los} \\ \text{cacahuates} \\ \text{(por libra)} \end{array} \right) \times \left(\begin{array}{c} \text{Cacahuates} \\ \text{vendidos} \\ \text{(en libras)} \end{array} \right)$$

$$y = 30 + 2x$$

- Hagan una tabla de valores. Hallen los valores de y si x es 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5 y 5.
- ¿Qué observan sobre la pendiente de la recta?
¿Qué representa la pendiente?

Supón que tu padre te da \$10 para gastar en cacahuates con un grupo de amigos. La cantidad de dinero que sobre depende de cuántos cacahuates ya han comprado tú y tus amigos.



$$\text{Cantidad que sobra} = \text{Cantidad inicial} - \left(\begin{array}{c} \text{Precio de los} \\ \text{cacahuates} \\ \text{(libra)} \end{array} \right) \times \left(\begin{array}{c} \text{Cacahuates} \\ \text{comprados} \\ \text{(libra)} \end{array} \right)$$

$$y = 10 - 2x$$

- Hagan una tabla de valores. Hallen el valor de y si x es 0, 2.5 y 5.
- Hagan una gráfica de los puntos en un plano de coordenadas. ¿En qué se diferencia esta gráfica de la primera gráfica? Expliquen.
- Expliquen qué representan los puntos (0, 10) y (5, 0).

¡Disfruten los cacahuates!

4.1 Start Thinking

In order to graph a linear equation in slope-intercept form, what do you need to know? What does the equation look like when the y -intercept of the line is equal to 0? What does the equation look like when it also has a slope equal to 1?

4.1 Warm Up

Graph the linear equation in a coordinate plane.

1. $y = \frac{3}{4}x + 2$

2. $y = -\frac{2}{3}x$

3. $y = -1$

4. $y = -2x - 4$

5. $y = \frac{2}{3}x + 2$

6. $x = -2$

4.1 Cumulative Review Warm Up

Determine whether the table represents a *linear* or *nonlinear* function. Explain.

1.

x	2	3	4	5
y	4	9	14	19

2.

x	6	8	10	12
y	-10	-4	-2	2

3.

x	-3	-1	1	3
y	0	2	2	0

4.1 Practice A

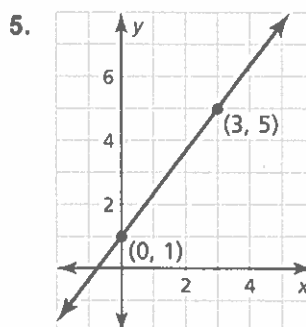
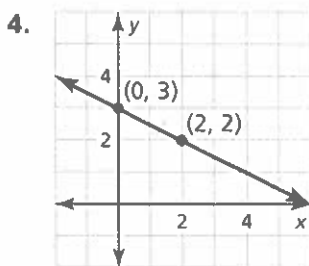
In Exercises 1–3, write an equation of the line with the given slope and y-intercept.

1. slope: 3
y-intercept: 8

2. slope: -4
y-intercept: 0

3. slope: 0
y-intercept: -2

In Exercises 4 and 5, write an equation of the line in slope-intercept form.



In Exercises 6–8, write an equation of the line that passes through the given points.

6. $(2, 3)$, $(0, 9)$

7. $(5, -2)$, $(0, -2)$

8. $(-1, 4)$, $(0, -2)$

In Exercises 9–11, write a linear function f with the given values.

9. $f(0) = 3$, $f(1) = 5$

10. $f(0) = 9$, $f(2) = 4$

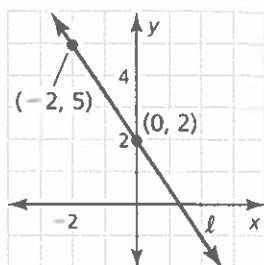
11. $f(3) = -2$, $f(0) = 1$

12. In 2003, a gallon of gas cost \$1.75. In 2013, a gallon of gas cost \$3.50.

a. Write a linear model that represents the cost (in dollars) of a gallon of gas as a function of the number of years since 2003.

b. Use the model to predict the cost of a gallon of gas in 2023.

13. Line ℓ is a reflection in the y -axis of line k . Write an equation that represents line k .



4.1 Practice B

In Exercises 1–3, write an equation of the line with the given slope and y-intercept.

1. slope: 3

y-intercept: -9

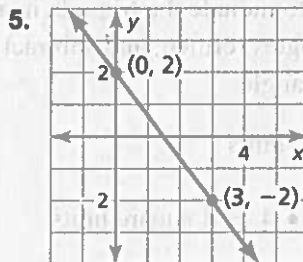
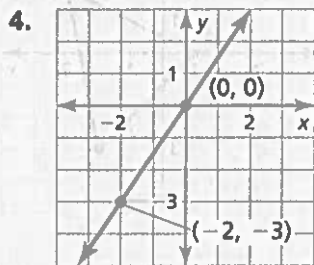
2. slope: 0

y-intercept: $\frac{1}{3}$

3. slope: $-\frac{2}{5}$

y-intercept: 7

In Exercises 4 and 5, write an equation of the line in slope-intercept form.



In Exercises 6–8, write an equation of the line that passes through the given points.

6. $(4, 0), (0, -7)$

7. $(0, -3), (-2.5, 2)$

8. $(0, 4), (-6, 1.5)$

In Exercises 9–11, write a linear function f with the given values.

9. $f(6) = -2, f(0) = -5$

10. $f(0) = -1, f(2) = -1$

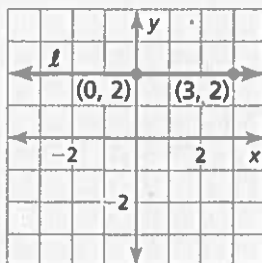
11. $f(-4) = 3, f(0) = -2$

12. A T-shirt design company charges your team an initial fee of \$25 to create the team's design. Each T-shirt printed with your design costs an additional \$8.

a. Write a linear model that represents the total cost of purchasing your team's T-shirts with your design as a function of the number of T-shirts.

b. Your team has 35 members. If a T-shirt is purchased for every member, what would be the cost?

13. Line ℓ is a reflection in the x -axis of line k . Write an equation that represents line k .



4.1 Enrichment and Extension

Coordinate Geometry: Area of a Polygon

How would you find the area of a triangle when the figure has no sides parallel to either axis?

Find the area of the triangle whose vertices are $A(-1, 0)$, $B(3, 2)$, and $C(2, -3)$.

A method for finding area is to include the triangle in a rectangle, find the area of the right triangles formed, and subtract those areas from the total area of the rectangle.

Area of rectangle = 20 square units

Area of triangle $X = \frac{1}{2} \cdot 2 \cdot 4 = 4$ square units

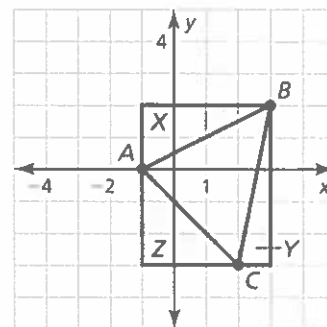
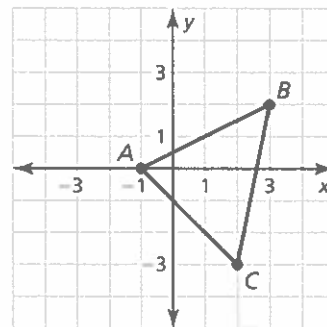
Area of triangle $Y = \frac{1}{2} \cdot 1 \cdot 5 = 2.5$ square units

Area of triangle $Z = \frac{1}{2} \cdot 3 \cdot 3 = 4.5$ square units

Area of $\triangle ABC = 20 - (4 + 2.5 + 4.5) = 20 - 11 = 9$ square units

In Exercises 1–5, find the area of the figure with the given vertices.

1. $X(-4, 2)$, $Y(1, 0)$, $Z(-2, -2)$
2. $E(0, 0)$, $F(-2, 3)$, $G(-5, -4)$
3. $A(-4, 3)$, $B(8, 10)$, $C(-2, -4)$
4. $J(-2, 2)$, $K(2, 4)$, $L(5, 0)$, $M(0, -2)$
5. $P(-3, 0)$, $Q(-2, 4)$, $R(2, 3)$, $S(2, 1)$, $T(1, -3)$





Puzzle Time

What Paces Back And Forth On The Ocean Floor?

Write the letter of each answer in the box containing the exercise number.

Write an equation of the line with the given slope and y -intercept.

1. slope: 3; y -intercept: -8

2. slope: $\frac{3}{4}$; y -intercept: 9

3. slope: $-\frac{1}{2}$; y -intercept: 0

4. slope: 5; y -intercept: $\frac{7}{8}$

Write an equation of the line that passes through the given points.

5. $(4, 2), (0, -6)$

6. $(2, -3), (0, -3)$

7. $(3, 0), (0, 4)$

8. $(0, -11), (9, 7)$

9. $(-8, 0.6), (0, 1.4)$

Write a linear function f with the given values.

10. $f(0) = -7, f(7) = 1$

11. $f(-10) = 0, f(0) = 5$

12. $f(12) = -\frac{1}{3}, f(0) = -\frac{1}{3}$

13. The water park charges \$125 for a birthday party. Guests cost \$12 each. Write a linear model that represents the total cost of a birthday party y as a function of the number of guests x .

Answers

K. $f(x) = \frac{1}{2}x + 5$

E. $y = \frac{3}{4}x + 9$

R. $y = -\frac{4}{3}x + 4$

S. $y = 5x + \frac{7}{8}$

W. $f(x) = -\frac{1}{3}$

V. $y = 2x - 11$

E. $y = 3x - 8$

A. $y = -3$

R. $y = 2x - 6$

C. $y = 0.1x + 1.4$

O. $y = -\frac{1}{2}x$

U. $f(x) = \frac{8}{7}x - 7$

N. $y = 12x + 125$

6		13	2	5	8	3	10	4		12	7	1	9	11
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4.2 Start Thinking

How can you find a linear equation from a graph for which you do not know the y -intercept? Describe a situation in which you might know the slope but not the y -intercept. Provide a graph of this situation.

4.2 Warm Up

Write an equation in slope-intercept form with the given slope and y -intercept.

1. $m = -3; b = 6$

2. $m = \frac{3}{2}; b = 2$

3. $m = 2; b = -2$

4. $m = -\frac{1}{2}; b = 4$

5. $m = 1; b = 5$

6. $m = -2; b = 9$

4.2 Cumulative Review Warm Up

Solve the formula for the indicated variable.

1. Profit: $P = R - C$; Solve for R .

2. Volume of a cylinder: $V = \pi r^2 h$; Solve for r .

3. Area of a trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$; Solve for h .

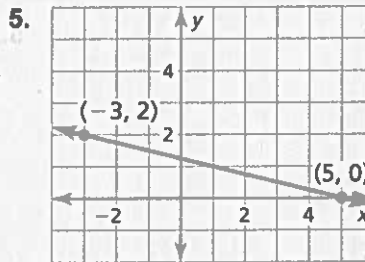
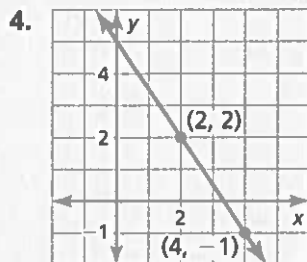
4. Average acceleration of an object: $a = \frac{v_1 - v_0}{t}$; Solve for t .

4.2 Practice A

In Exercises 1–3, write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(3, 1)$; $m = 4$
2. $(2, 7)$; $m = -3$
3. $(4, -3)$; $m = -5$

In Exercises 4 and 5, write an equation in slope-intercept form of the line shown.



In Exercises 6–8, write an equation in slope-intercept form of the line that passes through the given points.

6. $(6, 3)$, $(3, 10)$
7. $(5, -4)$, $(15, 2)$
8. $(4, -3)$, $(2, -9)$

In Exercises 9–11, write a linear function f with the given values.

9. $f(1) = 3$, $f(3) = 4$
10. $f(6) = 9$, $f(-5) = 0$
11. $f(-3) = 5$, $f(3) = 5$

In Exercises 12 and 13, tell whether the data in the table can be modeled by a linear equation. Explain. If possible, write a linear equation that represents y as a function of x .

12.

x	1	3	5	7	9
y	-2	4	7	14	22

13.

x	-2	0	2	4	6
y	-3	0	3	6	9

14. You are renting a paddle board. The company charges a \$50 fee and \$20 per half-day.

- a. Write an equation that represents the total cost (in dollars) of renting a paddle board as a function of the number of half-days.
- b. Find the total cost of renting a paddle board for 7 half-days.

4.2 Practice B

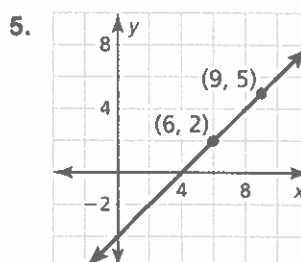
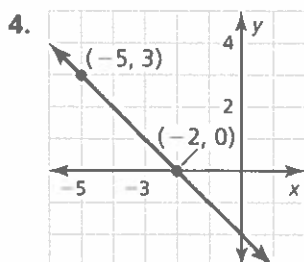
In Exercises 1–3, write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(-4, 5); m = 1$

2. $(3, 4); m = \frac{1}{3}$

3. $(2, -6); m = -\frac{1}{4}$

In Exercises 4 and 5, write an equation in slope-intercept form of the line shown.



In Exercises 6–8, write an equation in slope-intercept form of the line that passes through the given points.

6. $(-3, 6), (-5, -6)$

7. $(2, -4), (5, -4)$

8. $(-7, 18), (7, 14)$

In Exercises 9–11, write a linear function f with the given values.

9. $f(-5) = 2, f(7) = -4$

10. $f(-2) = 1, f(12) = 7$

11. $f(-8) = 12, f(-3) = -3$

In Exercises 12 and 13, tell whether the data in the table can be modeled by a linear equation. Explain. If possible, write a linear equation that represents y as a function of x .

12.

x	0	1	2	3	4
y	3.5	3	2.5	2	1.5

13.

x	0	2	4	6	8
y	1	2	4	8	16

14. The equation $y - 2 = \frac{5}{4}(x + 8)$ represents the cost (in dollars) of making your own juice (in fluid ounces).

- What is the slope of the line? Interpret the slope in the context of this situation.
- Write the equation as a linear function.
- Use the linear function in part (b) to determine the base cost of making your own juice.

4.2 Enrichment and Extension

Challenge: Writing Point-Slope Form

Point-slope form of a line is very applicable in both algebra and geometry. It is very simple to write point-slope form from a figure or line on a graph, but suppose you had another form of an equation. How would you rewrite it in point-slope form?

Example: If $\frac{1}{3}y - x = -\frac{1}{6}x - 3$, write the point-slope form of the line given (you must get whole-number coordinates).

$$\frac{1}{3}y - x = -\frac{1}{6}x - 3$$

$$6\left(\frac{1}{3}y - x\right) = 6\left(-\frac{1}{6}x - 3\right) \quad \text{Multiply each side by 6.}$$

$$2y - 6x = -x - 18$$

$$2y = 5x - 18 \quad \text{Combine like terms.}$$

$$2y - 2 = 5x - 18 - 2 \quad \text{Because 18 is not divisible by 5, subtract 2 from each side.}$$

$$2y - 2 = 5x - 20$$

$$2(y - 1) = 5(x - 4) \quad \text{Factor 2 from the left side of the equation, and factor 5 from the right.}$$

$$y - 1 = \frac{5}{2}(x - 4) \quad \text{Divide by 2.}$$

In Exercises 1–4, write the linear equation in point-slope form. You must try to get whole-number coordinates.

1. $\frac{1}{4}y - 1 = \frac{1}{2}x + 7$

2. $-\frac{1}{10}y - 3 = \frac{1}{5}x$

3. $\frac{1}{2}y - 3x = -x - 1$

4. $2y - 4 = 3x + 5$

Months, x	1	2	3	4	5	6	7	8	9	10	11	12
Total cost (dollars), $f(x)$	40	100	160	220	280	340	400	460	520	580	640	700

1	2	3	4	5	6	7	8	9	10	11	12



Puzzle Time

What Did The Wall Say To The Bookcase?

Write the letter of each answer in the box containing the exercise number.

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(5, 6), m = 4$ 2. $(-7, 0), m = -\frac{1}{8}$

3. $(-1, -2), m = -1$ 4. $(-3, 11), m = \frac{4}{9}$

Write an equation in slope-intercept form of the line that passes through the given points.

5. $(9, 4), (4, -11)$ 6. $(8, 10), (12, 13)$

7. $(14, -15), (7, -15)$ 8. $(6, 1), (4, 16)$

Write a linear function f with the given values.

9. $f(3) = -3, f(2) = 2$

10. $f(3) = 9, f(-4) = 2$

11. $f(-10) = 4, f(8) = -5$

12. $f(-12) = 6, f(-4) = 6$

13. You pay a registration fee and a monthly fee to join a local fitness center. The table shows the total cost of joining the fitness center for different numbers of months. Write an equation that represents the total cost (in dollars) of joining the fitness center as a function of the number of months.

Months, x	3	5	7
Total cost (dollars), $f(x)$	100	140	180

Answers

L. $y + 2 = -(x + 1)$

H. $f(x) = 20x + 40$

Y. $y = -7.5x + 46$

E. $y - 6 = 4(x - 5)$

S. $y = -15$

E. $y = 0.75x + 4$

F. $y - 11 = \frac{4}{9}(x + 3)$

R. $f(x) = x + 6$

H. $f(x) = -0.5x - 1$

P. $f(x) = -5x + 12$

U. $y - 0 = -\frac{1}{8}(x + 7)$

O. $y = 3x - 23$

L. $f(x) = 6$

11	6	3	9		8	5	2	10	7	13	1	12	4
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4.3 Start Thinking

Use your knowledge of slope to explain how you can determine if two lines are parallel by looking at their graphs.

Graph the lines $y = 5x$ and $y = -5x$. Do the lines make 90° angles at the point of intersection? Does this prove or disprove the idea that perpendicular lines have opposite slopes?

4.3 Warm Up

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

1. $(-5, -7); m = -3$

2. $(9, -3); m = \frac{8}{3}$

3. $(0, -1); m = 3$

4. $(2, 0); m = -1$

5. $(-4, 2); m = -\frac{4}{7}$

6. $(-5, -3); m = \frac{1}{2}$

4.3 Cumulative Review Warm Up

Write the sentence as an inequality. Graph the inequality.

1. A number q is greater than 7 or less than 1.

2. A number p is greater than or equal to -6 and less than 11.

3. A number n is less than $-6\frac{1}{4}$ and at least -11 .

4. A number s is no more than -0.4 or greater than 10.4.

4.3 Practice A

In Exercises 1 and 2, determine which of the lines, if any, are parallel. Explain.

- | | |
|---|--|
| 1. Line a passes through $(-1, 1)$ and $(1, 3)$.
Line b passes through $(3, 4)$ and $(0, 2)$.
Line c passes through $(0, 1)$ and $(3, 3)$. | 2. Line $a: 2y = x + 12$
Line $b: 2y - x = 5$
Line $c: 2y + x = 4$ |
|---|--|

In Exercises 3 and 4, write an equation of the line that passes through the given point and is parallel to the given line.

- | | |
|-------------------------|---------------------------|
| 3. $(1, 3); y = 2x - 5$ | 4. $(-2, 1); y = -4x + 3$ |
|-------------------------|---------------------------|

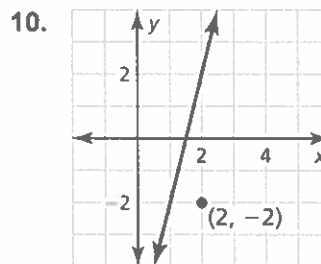
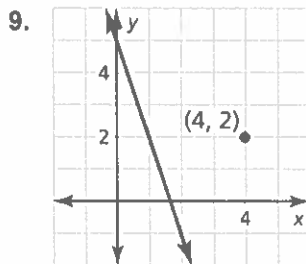
In Exercises 5 and 6, determine which of the lines, if any, are parallel or perpendicular. Explain.

- | | |
|--|---|
| 5. Line a passes through $(-2, 3)$ and $(1, -1)$.
Line b passes through $(-3, 1)$ and $(1, 4)$.
Line c passes through $(0, 2)$ and $(3, -2)$. | 6. Line $a: y = -4x + 7$
Line $b: x = 4y + 2$
Line $c: -4y + x = 3$ |
|--|---|

In Exercises 7 and 8, write an equation of the line that passes through the given point and is perpendicular to the given line.

- | | |
|------------------------------------|------------------------------------|
| 7. $(2, -3); y = \frac{1}{3}x - 5$ | 8. $(6, 1); y = -\frac{3}{5}x - 5$ |
|------------------------------------|------------------------------------|

In Exercises 9 and 10, write an equation of the line that passes through the given point and is (a) parallel and (b) perpendicular to the given line.



In Exercises 11–13, determine whether the statement is *sometimes*, *always*, or *never* true. Explain your reasoning.

11. A line with a positive slope and a line with a negative slope are parallel.
12. A vertical line is perpendicular to the x -axis.
13. Two lines with the same x -intercept are perpendicular.

4.3 Practice B

In Exercises 1 and 2, determine which of the lines, if any, are parallel. Explain.

- Line a passes through $(-1, 4)$ and $(1, 5)$.
Line b passes through $(-2, 7)$ and $(0, 4)$.
Line c passes through $(0, 4)$ and $(2, 5)$.
- Line $a: 6y = -x + 12$
Line $b: x = 6y + 5$
Line $c: -6y + x = 5$

In Exercises 3 and 4, write an equation of the line that passes through the given point and is parallel to the given line.

- $(14, 3); 2y - x = 8$
- $(3, -5); 3y = 2x - 1$

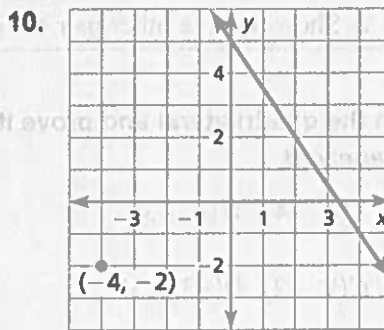
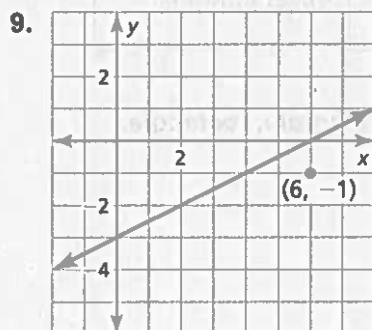
In Exercises 5 and 6, determine which of the lines, if any, are parallel or perpendicular. Explain.

- Line a passes through $(-5, -2)$ and $(1, -1)$.
Line b passes through $(-3, 5)$ and $(3, 6)$.
Line c passes through $(0, 7)$ and $(1, 1)$.
- Line $a: -x + 2y = 3$
Line $b: -6x = 3y - 1$
Line $c: 4x - 8y = 5$

In Exercises 7 and 8, write an equation of the line that passes through the given point and is perpendicular to the given line.

- $(-3, 1); y = -5x + 2$
- $(8, -5); y = 2x + 3$

In Exercises 9 and 10, write an equation of the line that passes through the given point and is (a) parallel and (b) perpendicular to the given line.



In Exercises 11–13, determine whether the statement is *sometimes*, *always*, or *never* true. Explain your reasoning.

- A line with a positive slope and a line with a negative slope are perpendicular.
- A vertical line and a horizontal line are perpendicular.
- Two horizontal lines are perpendicular.

4.3 Enrichment and Extension

Coordinate Geometry Proofs

Recall that two lines are parallel if their slopes are equal, and two lines are perpendicular if their slopes are negative reciprocals. In geometry, we can prove that four-sided figures are certain quadrilaterals by using the following formulas and rules for each specific quadrilateral.

Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Midpoint Formula: $\left(\frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2} \right)$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Coordinate Proof Methods:

Quadrilateral	Prove the following	Formulas needed
Parallelogram	Show that each pair of opposite sides are parallel.	Slope Formula
Rectangle	1. Show that opposite sides are parallel. 2. Show that adjacent sides are perpendicular.	Slope Formula
Rhombus	Show that all sides are congruent.	Distance Formula
Square	1. Show that the figure is a parallelogram. 2. Show the figure is a rhombus.	Slope Formula Distance Formula
Trapezoid	1. Show that one pair of opposite sides is parallel. 2. Show that the other pair of sides is not parallel.	Slope Formula

In Exercises 1–4, graph the quadrilateral and prove it is either a *parallelogram*, *rectangle*, *rhombus*, *square*, or *trapezoid*.

1. $J(-2, 3)$, $K(4, 2)$, $L(6, -4)$, $M(0, -3)$
2. $A(-2, 0)$, $B(6, 2)$, $C(9, -2)$, $D(-3, -5)$
3. $W(-6, -3)$, $X(-4, 3)$, $Y(2, 1)$, $Z(0, -5)$
4. $D(-3, 3)$, $E(0, 3)$, $F(0, -2)$, $G(-3, -2)$



Puzzle Time

What Do Snowmen Wear On Their Heads?

Write the letter of each answer in the box containing the exercise number.

Determine whether the lines are parallel, perpendicular, or neither.

1. Line a passes through $(-2, -5)$ and $(0, -1)$; Line b passes through $(3, 1)$ and $(1, -3)$.

A. parallel B. perpendicular C. neither

2. Line a passes through $(1, 4)$ and $(3, 6)$; Line b passes through $(-3, -6)$ and $(-1, -3)$.

A. parallel B. perpendicular C. neither

3. Line a passes through $(-4, 5)$ and $(-2, 8)$; Line b passes through $(-6, 7)$ and $(-3, 5)$.

R. parallel S. perpendicular T. neither

4. line a : $5y - 2x = 9$; line b : $2y + 5x = -6$

D. parallel E. perpendicular F. neither

5. line a : $4y = 8x + 12$; line b : $6y - 12x = 24$

I. parallel J. perpendicular K. neither

6. Write an equation of the line that passes through $(-4, -6)$ and is parallel to $y = 3x - 8$.

A. $y = 3x - 18$ B. $y = 3x - 6$ C. $y = 3x + 6$

7. Write an equation of the line that passes through $(2, 5)$ and is perpendicular to $y = \frac{1}{4}x - 12$.

O. $y = -4x + 3$ P. $y = -4x + 13$ Q. $y = -4x - 13$

5	2	4		6	1	7	3
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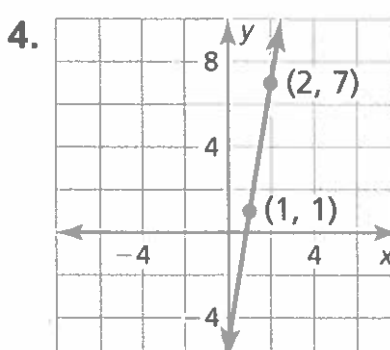
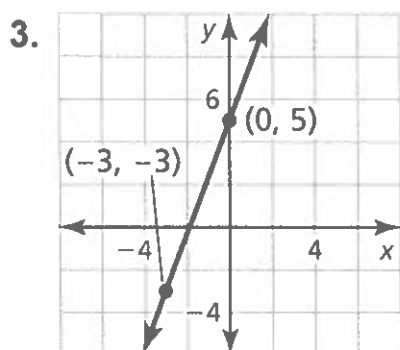
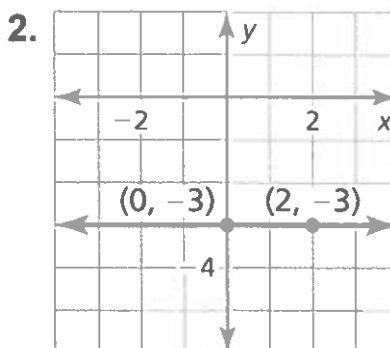
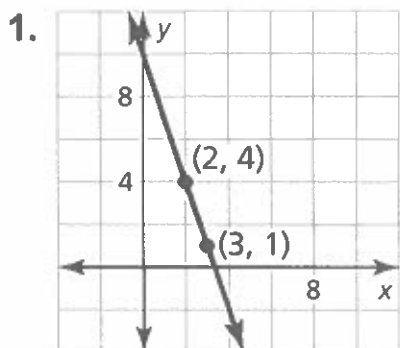
4.4 Start Thinking

Sketch a coordinate plane, showing only the first quadrant. Draw line q with any positive slope, horizontal line r , and line s with any negative slope.

Describe what happens to the y -values as the x -values increase for each line. Give an example of one real-life situation that represents each type of slope.

4.4 Warm Up

Use the graph to write an equation of the line in slope-intercept form.



4.4 Cumulative Review Warm Up

Graph the linear equation. Identify the x -intercept.

1. $y = x - 5$

2. $y = 3x$

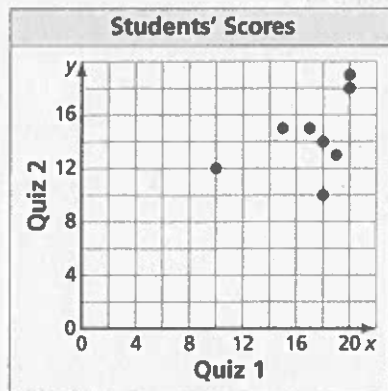
3. $2x - 2y = -2$

4. $y - 3x = 1$

4.4

Practice A

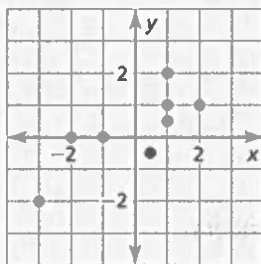
1. The scatter plot shows students' scores for Quiz 1 and Quiz 2.



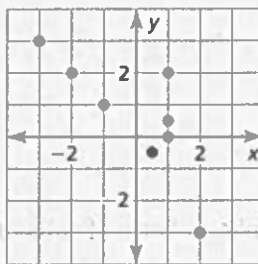
- What is the Quiz 1 score for a student who earned a score of 13 on Quiz 2?
- Did any student(s) earn the same score on both Quiz 1 and Quiz 2? Explain.
- Does there appear to be a difference between the Quiz 1 scores and the Quiz 2 scores? Explain.

In Exercises 2 and 3, tell whether x and y show a *positive*, a *negative*, or *no* correlation.

2.



3.



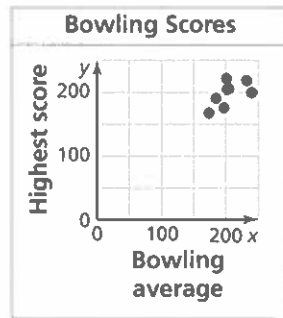
4. The table shows the number y of pineapple plants in a garden x years since 2004.

x	2	3	4	7	8	9
y	4	7	9	15	16	19

- Write an equation that models the approximate number of pineapple plants as a function of the number of years since 2004.
- Interpret the slope and y -intercept of the line of fit.

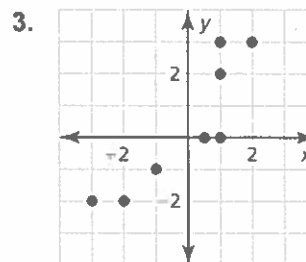
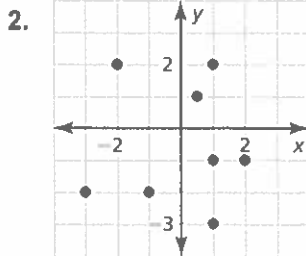
4.4 Practice B

1. The scatter plot shows the prior bowling averages of competitors at the bowling tournament and their highest scores during the tournament.



- How many competitors bowled above their average during the tournament?
- Did any bowler(s) bowl their average as their highest score? Explain.
- What are the scores of the competitors with the greatest difference between their bowling average and their highest score?

In Exercises 2 and 3, tell whether x and y show a *positive*, a *negative*, or *no* correlation.



4. The table shows the total number y of rolls of wrapping paper sold by a student after x weeks.

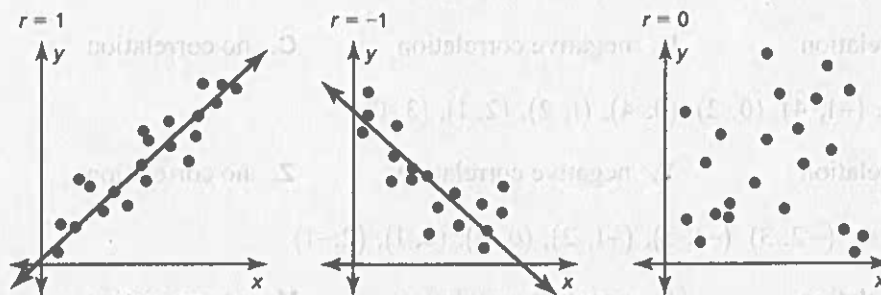
x	1	2	3	4	5	6
y	3	5	9	12	17	24

- Write an equation that models the number of rolls of wrapping paper as a function of the number of weeks.
- Interpret the slope and y -intercept of the line of fit.

4.4 Enrichment and Extension

Correlation Coefficient

In data analysis, there is a useful number called the *correlation coefficient*. This number gives a measure of how well a group of data is clustered around a line of best fit. If the data points are clustered closely around a line with positive slope, then the correlation coefficient r is close to 1. The value of r is close to -1 when the data points are clustered closely around a line with negative slope. If there is no close correlation, then the value of r is close to 0.



How to calculate the correlation coefficient:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

In Exercises 1 and 2, use the formula to find the correlation coefficient for the set of data.

1. age of Labrador puppies vs. weight

Weeks	Weight (pounds)
0	0.8
1	1.2
2	2
3	5
4	6.5
5	8
6	10.7
7	12.5

2. hours studying vs. grade on exam

Hours	Grade
1	75
1	69
2	80
2	81
2	78
3	86
3	71
4	89

4.4 Puzzle Time

On What Day Do Spiders Eat The Most?

Write the letter of each answer in the box containing the exercise number.

Using a scatter plot of the data, tell whether x and y show a *positive*, a *negative*, or *no* correlation.

1. $(-3, -2), (-2, 0), (-1, 1), (0, 0), (0, 1), (0, 2), (1, 2), (2, 3)$

A. positive correlation B. negative correlation C. no correlation

2. $(-2, 5), (-1, 3), (-1, 4), (0, 2), (0, 4), (1, 2), (2, 1), (3, 0)$

X. positive correlation Y. negative correlation Z. no correlation

3. $(-3, 4.5), (-2, 4), (-2, 3), (-1, 3), (-1, 2), (0, 0), (0, 1), (2, -1)$

K. positive correlation L. negative correlation M. no correlation

4. $(-3, 0), (-3, -4), (-2, -2), (-2, 2), (0, 0), (1, -3), (2, -2), (3, 2)$

B. positive correlation C. negative correlation D. no correlation

5. The table shows the daily ticket sales of the latest movie. Using a scatter plot of the data, write an equation that models ticket sales as a function of the number of days that the movie has been in theaters.

Days, x	1	2	3	4	5	6	7	8
Sales (millions), y	18	17	15	13	12	9	6	4

E. $y = -2x - 20$ F. $y = -2x + 20$ G. $y = 2x + 20$

6. The table shows the number of vehicles y that were cleaned at the car wash x hours since the car wash opened. Using a scatter plot of the data, write an equation that models the number of vehicles as a function of the number of hours since the car wash opened.

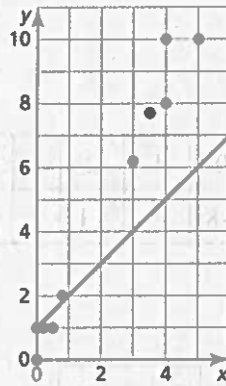
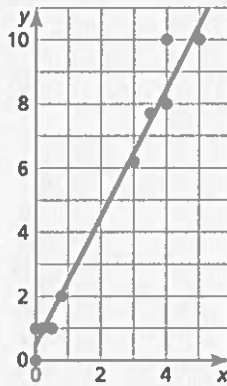
Hours, x	1	3	4	6	7	8	9	12
Vehicles, y	2	4	4	7	8	10	11	13

W. $y = x - 1$ X. $y = -x + 1$ Y. $y = x + 1$

5	3	6	4	1	2
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4.5 Start Thinking

Compare the scatter plots below. Which line best represents the data? Support your answer with evidence from the graphs.



4.5 Warm Up

Plot the points from the table in a coordinate plane. Write the equation of the line in slope-intercept form.

1.

x	-3	-2	-1	0	1
y	-19	-13	-7	-1	5

2.

x	2	3	4	5	6
y	12	18	24	30	36

4.5 Cumulative Review Warm Up

Solve the equation. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

1. $4t - 3 = 13 + 4t$

2. $3h = 6h + 6$

3. $14y - 5 = 7(2y - 2)$

4. $2(5g - 5) = 3(5g - 10)$

5. $3(6 - 4m) = 2(9 - 6m)$

6. $3(t - 5) = \frac{2}{5}(25 + 10t)$

4.5 Practice A

In Exercises 1 and 2, use residuals to determine whether the model is a good fit for the data in the table. Explain.

1. $y = \frac{7}{2}x - 8$

x	-4	-3	-2	-1	0	1	2	3	4
y	-21	-19	-15	-12	-8	-4	-1	2	6

2. $y = -4x + 27$

x	1	2	3	4	5	6	7	8	9
y	24	22	19	18	15	11	9	6	5

In Exercises 3 and 4, use a graphing calculator to find an equation of the line of best fit for the data. Identify and interpret the correlation coefficient.

3.

x	1	2	3	4	5	6	7	8	9
y	-7	-4	-1	0	0	1	4	7	9

4.

x	-5	-3	-1	1	3	5	7	9	11
y	20	18	15	14	12	9	7	4	2

5. The table shows the number of people x in a room and the temperature in the room in degrees Fahrenheit, y .

x	0	1	2	3	4	5	6	7	8
y	76	76	77	77	78	79	79	80	82

- Use a graphing calculator to find an equation of the line of best fit.
- Identify and interpret the correlation coefficient.
- Interpret the slope and y -intercept of the line of best fit.
- Approximate the temperature when 15 people are in the room.

4.5 Practice B

In Exercises 1 and 2, use residuals to determine whether the model is a good fit for the data in the table. Explain.

1. $y = \frac{3}{2}x - 10$

x	2	4	6	8	10	12	14	16	18
y	-1	-1	1	2	5	6	8	10	14

2. $y = -2x + 56$

x	1	2	3	4	5	6	7	8	9
y	52	50	48	47	45	42	41	38	35

In Exercises 3 and 4, use a graphing calculator to find an equation of the line of best fit for the data. Identify and interpret the correlation coefficient.

3.

x	-12	-8	-4	0	4	8	12	16	20
y	48	42	37	31	29	24	19	14	7

4.

x	3	4	5	6	7	8	9	10	11
y	20	36	15	32	12	28	17	16	24

5. The table shows the average number of minutes y per kilometer for runners and the total distance of a running race, x (in kilometers).

x	3.1	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9
y	5.4	5.6	5.7	5.9	6.0	6.1	6.3	6.5	6.9

- Use a graphing calculator to find an equation of the line of best fit.
- Identify and interpret the correlation coefficient.
- Interpret the slope and y -intercept of the line of best fit.
- Approximate the average number of minutes per kilometer when the distance of a race is 31 kilometers.

4.5 Enrichment and Extension**Frequency and Percentiles**

When test scores are reported, students are put into a certain percentile based on their grade compared to others who have taken the same test. The table shows certain test scores and their frequencies. The frequency is the number of students who had a particular score.

Example: What score is in the 18th percentile?

A score at the 18th percentile is the score that is just above the lowest 18% of scores. There are 50 scores, so the lowest 18% of the 50 total consists of 9 scores. The highest of these scores is a 55, so then the score at the 18th percentile would be also be a 55.

Score	Frequency
95	1
90	3
85	4
80	6
75	7
70	8
65	6
60	5
55	4
50	3
45	2
40	1

In Exercises 1–6, use the table above to find the score at the percentile.

1. 40th percentile
2. 50th percentile
3. 80th percentile
4. 58th percentile
5. 92nd percentile
6. 34th percentile

In Exercises 7–9, use the table above to find the percentile at the score.

7. a score of 45
8. a score of 80
9. a score of 75



4.5 Puzzle Time

What Did The Mother Buffalo Say To Her Son Before He Left?

Write the letter of each answer in the box containing the exercise number.

Use a graphing calculator to determine whether the model is a good fit for the data in the table.

1. $y = 3x - 6$

x	-7	-5	-3	-1	0	1	3	5	7
y	-26	-22	-15	-8	-7	-3	4	8	16

O. yes

P. no

2. $y = -2x + 8$

x	0	1	2	3	4	5	6	7	8
y	9	7	4	1	-1	-3	-4	-5	-8

I. yes

J. no

3. $y = -0.2x + 15$

x	-40	-30	-20	-10	0	10	20	30	40
y	27	23	17	14	12	0	-4	-7	-11

M. yes

N. no

Use a graphing calculator to find an equation of the line of best fit for the data.

4.

x	-12	-9	-6	-3	0	3	6	9	12
y	-27	-15	-2	6	21	30	42	58	67

Q. $y = -3.9x - 20$

R. $y = 3.9x - 20$

S. $y = 3.9x + 20$

5.

x	-4	-3	-2	-1	0	1	2	3	4
y	15	12	5	3	-5	-10	-13	-20	-23

A. $y = 4.95x + 4$

B. $y = -4.95x - 4$

C. $y = -4.95x + 4$

5	2	4	1	3
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4.6 Practice B

In Exercises 1 and 2, write the next three terms of the arithmetic sequence.

1. First term: 8
Common difference: 5
2. First term: 40
Common difference: -12

In Exercises 3–6, find the common difference of the arithmetic sequence.

3. $-4, -1, 2, 5, \dots$
4. $\frac{2}{7}, \frac{4}{7}, \frac{6}{7}, \frac{8}{7}, \dots$
5. $8.6, 8.4, 8.2, 8.0, \dots$
6. $7\pi, 5\pi, 3\pi, \pi, \dots$

In Exercises 7 and 8, graph the arithmetic sequence.

7. $4, 18, 32, 46, \dots$
8. $10, 7.5, 5, 2.5, \dots$

In Exercises 9 and 10, determine whether the sequence is arithmetic. If so, find the common difference.

9. $67, 52, 37, 22, \dots$
10. $128, 32, 8, 2, \dots$

In Exercises 11–14, write an equation for the n th term of the arithmetic sequence. Then find a_{10} .

11. $-9, -1, 7, 15, \dots$
12. $\frac{1}{3}, \frac{2}{3}, 1, 1\frac{1}{3}, \dots$
13. $-160, -180, -200, -220, \dots$
14. $-\frac{7}{3}, -\frac{5}{3}, -1, -\frac{1}{3}, \dots$

15. The first term of an arithmetic sequence is 3. The common difference of the sequence is 10 less than twice the first term. Write the next three terms of the sequence.

16. The volume (in cubic feet) of the water in a tank each hour after turning on a faucet can be estimated by the sequence in the table.

Hours after turning on faucet	1	2	3	4
Volume (cubic feet)	12	15	18	21

- a. Write a function that represents the arithmetic sequence.
- b. The tank is in the shape of a rectangular box. The length is 6 feet, the width is 3 feet, and the height is 2 feet. Find the n th term that represents a full tank. Explain.

4.6 Enrichment and Extension

Arithmetic Series

An arithmetic series is the sum of a certain number of terms in a sequence. Let S stand for the following series, which starts with 5 and each consecutive term is 5 more than the previous term.

$$S = 5 + 10 + 15 + 20 + 25 + 30$$

Series formula: The series will stay the same when you reverse the terms. After you do this, add the two series together to obtain a final formula.

So, the series formula is $S = \frac{n}{2}(a_1 + a_n)$,

where n is the number of terms, a_1 is the first term, and a_n is the last term.

$$S = 5 + 10 + 15 + 20 + 25 + 30$$

$$S = 30 + 25 + 20 + 15 + 10 + 5$$

$$2S = 35 + 35 + 35 + 35 + 35 + 35$$

$$2S = 6(35)$$

$$S = \frac{6(35)}{2} = 105$$

$$S = \frac{n}{2}(a_1 + a_n)$$

Example: Find the sum $-5 + (-2) + 1 + 4 + 7 + 10 + 13 + 16$.

$$a_1 = -5, a_n = 16, n = 8, \text{ so } S = \frac{8}{2}(-5 + 16) = 4(11) = 44.$$

In Exercises 1–8, find the sum of the arithmetic series.

1. $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10$

2. $-6 + (-1) + 4 + 9 + 14 + 19 + 24$

3. $90 + 99 + 108 + 117 + 126 + 135 + 144 + 153$

4. $\frac{1}{2} + 2 + 3\frac{1}{2} + 5 + 6\frac{1}{2} + 8 + 9\frac{1}{2}$

5. $27 + 23 + 19 + 15 + 11$

6. $(x + 3) + (2x + 5) + (3x + 7) + (4x + 9) + (5x + 11)$

7. odd whole numbers from 1 to 99

8. even integers from 0 to 50

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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4.6 Puzzle Time

What Do You Get When You Cross A Centipede With A Parrot?

Write the letter of each answer in the box containing the exercise number.

Write the next three terms of the arithmetic sequence.

1. First term: 4; Common difference: 9
2. First term: 22; Common difference: -8
3. 3, 11, 19, 27, ...
4. $-3, -5, -7, -9, \dots$
5. $-17, -8\frac{1}{2}, 0, 8\frac{1}{2}, \dots$
6. 5.4, 4, 2.6, 1.2, ...

Use an equation for the n th term of the arithmetic sequence to find a_{12} .

7. 2, 4, 6, 8, ...
8. $\frac{10}{11}, \frac{9}{11}, \frac{8}{11}, \frac{7}{11}, \dots$
9. $-10, -5, 0, 5, \dots$
10. $-7, -9, -11, -13, \dots$
11. $-2\frac{2}{3}, -2\frac{1}{3}, -2, -1\frac{2}{3}, \dots$
12. $-0.25, 0.25, 0.75, 1.25, \dots$
13. The temperature of some water increases 2°F every hour after an initial temperature of 50°F . Use an equation for the n th term of the arithmetic sequence to find a_6 , the temperature of the water in $^\circ\text{F}$ after 6 hours.

Answers

- A. 14, 6, -2
- I. 24
- L. -29
- A. $-11, -13, -15$
- E. $-\frac{1}{11}$
- L. $17, 25\frac{1}{2}, 34$
- K. 1
- E. 13, 22, 31
- A. 45
- W. 5.25
- T. 60
- K. $-0.2, -1.6, -3$
- I. 35, 43, 51

4		12	2	10	6	3	8		13	9	5	11	7	1
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4.7 Start Thinking

Use work at a photo processing facility. The price for processing 50 photos or fewer is \$0.35 per photo. If a customer wants more than 50 photos, the cost is \$18.00 plus \$0.29 per photo.

The situation described above can be thought of as two separate equations. Write a linear equation for each, specifying the domain.

4.7 Warm Up

Evaluate the function.

1. $f(x) = 6x + 2$, if $x = -3$
2. $g(x) = 3x + 4$, if $x = 3$
3. $y = x + 5$, if $x = 3$
4. $y = -3x$, if $x = -2$
5. $f(x) = 4x + 3$, if $x = -3$
6. $g(x) = 5x + 3$, if $x = 5$

4.7 Cumulative Review Warm Up

Graph and compare the two functions.

1. $f(x) = |x| - 3$; $g(x) = |x| - 7$
2. $s(x) = |3x + 4| + 7$; $t(x) = |x + 4| + 7$
3. $v(x) = -|2x - 2| - 3$; $w(x) = 4|2x - 2| + 5$
4. $c(x) = 5|x - 2| + 2$; $d(x) = -\frac{3}{4}|x - 2| - 2$

4.7 Practice A

In Exercises 1–6, evaluate the function.

$$f(x) = \begin{cases} 2x + 3, & \text{if } x < 0 \\ x - 5, & \text{if } x \geq 0 \end{cases}$$

1. $f(-2)$

2. $f(4)$

3. $f(1)$

4. $f(0)$

5. $f\left(-\frac{1}{2}\right)$

6. $f(10)$

7. On a trip, the total distance (in miles) you travel in x hours is represented by the piecewise function

$$d(x) = \begin{cases} 55x, & \text{if } 0 \leq x < 1.5 \\ 82.5, & \text{if } 1.5 \leq x < 4 \\ 82.5 + 320(x - 4), & \text{if } x \geq 4 \end{cases}$$

- How far did you travel in 1.5 hours? 3 hours? 4.5 hours?
- Write a real situation that could be represented by this piecewise function.

In Exercises 8–11, graph the function. Describe the domain and range.

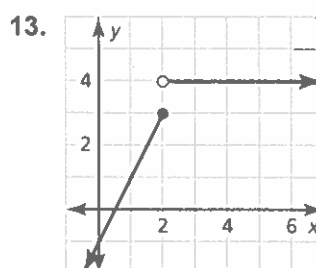
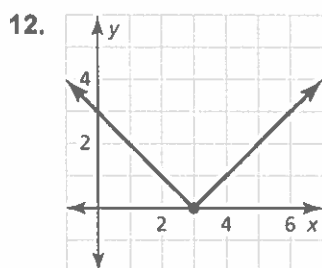
8. $f(x) = \begin{cases} -x, & \text{if } x < 3 \\ x + 4, & \text{if } x \geq 3 \end{cases}$

9. $f(x) = \begin{cases} -3x, & \text{if } x \leq -1 \\ 3x, & \text{if } x > -1 \end{cases}$

10. $f(x) = \begin{cases} x + 6, & \text{if } x < -2 \\ -2x, & \text{if } x \geq -2 \end{cases}$

11. $f(x) = \begin{cases} -x + 2, & \text{if } x < 0 \\ x - 2, & \text{if } x \geq 0 \end{cases}$

In Exercises 12 and 13, write a piecewise function for the graph.



In Exercises 14–17, write the absolute value function as a piecewise function.

14. $y = |x| + 3$

15. $y = |x| - 2$

16. $y = |x + 1|$

17. $y = |x - 4|$

4.7 Practice B

In Exercises 1–6, evaluate the function.

$$f(x) = \begin{cases} -x + 2, & \text{if } x < -3 \\ 7, & \text{if } -3 \leq x < 0 \\ 3x - 1, & \text{if } x \geq 0 \end{cases}$$

1. $f(-5)$

2. $f(4)$

3. $f(1)$

4. $f(0)$

5. $f\left(-\frac{1}{2}\right)$

6. $f(-3)$

7. The total cost (in dollars) of ordering graduation announcements is represented by the piecewise function

$$c(x) = \begin{cases} 1.5x + 15, & \text{if } 0 \leq x < 25 \\ 1.25x + 15, & \text{if } 25 \leq x < 40 \\ x + 15, & \text{if } x \geq 40 \end{cases}$$

- Determine the cost of ordering 25 announcements. Then determine the cost of ordering 24 announcements.
- For what number of announcements less than 25 is it financially better to purchase 25 announcements?
- For what number of announcements less than 40 is it financially better to purchase 40 announcements?

In Exercises 8–11, graph the function. Describe the domain and range.

8. $f(x) = \begin{cases} -x + 5, & \text{if } x < 5 \\ x - 5, & \text{if } x \geq 5 \end{cases}$

9. $f(x) = \begin{cases} 2x - 3, & \text{if } x \leq -1 \\ 2x + 2, & \text{if } x > -1 \end{cases}$

10. $f(x) = \begin{cases} -x + 1, & \text{if } x < -3 \\ 4, & \text{if } -3 \leq x < 0 \\ 3x + 4, & \text{if } x \geq 0 \end{cases}$

11. $f(x) = \begin{cases} x + 3, & \text{if } x < -2 \\ x - 2, & \text{if } -2 \leq x < 2 \\ -2, & \text{if } x \geq 2 \end{cases}$

In Exercises 12–15, write the absolute value function as a piecewise function.

12. $y = |x - 3|$

13. $y = -2|x + 4|$

14. $y = -|x + 1| + 3$

15. $y = 5|x - 2| + 1$

4.7 Enrichment and Extension

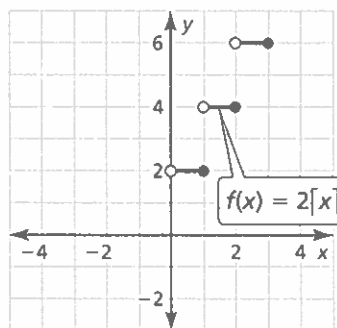
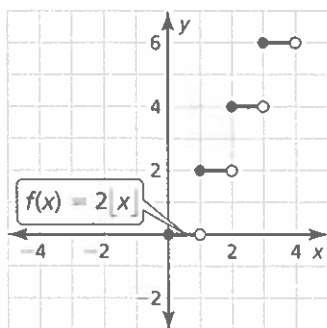
Greatest and Least Integer Functions

For any real number x , $f(x) = \lfloor x \rfloor$ denotes the greatest integer less than or equal to x .

For any real number x , $f(x) = \lceil x \rceil$ denotes the least integer greater than or equal to x .

Example:

$$f(x) = 2\lfloor x \rfloor; f(x) = \begin{cases} 0, & \text{if } 0 \leq x < 1 \\ 2, & \text{if } 1 \leq x < 2 \dots \\ 4, & \text{if } 2 \leq x < 3 \end{cases} \text{ and } f(x) = 2\lceil x \rceil = \begin{cases} 2, & \text{if } 0 < x \leq 1 \\ 4, & \text{if } 1 < x \leq 2 \dots \\ 6, & \text{if } 2 < x \leq 3 \end{cases}$$



In Exercises 1–6, graph and write an equivalent piecewise function.

1. $f(x) = \lfloor x \rfloor + 3$
2. $f(x) = \lceil x + 3 \rceil$
3. $f(x) = \lceil -x \rceil$
4. $f(x) = -\frac{1}{2}\lfloor x \rfloor$
5. $f(x) = \lfloor 2x \rfloor$
6. $f(x) = \lfloor 3x \rfloor + 2$

4.7 Puzzle Time

What Do You Call A Nervous Zucchini?

Write the letter of each answer in the box containing the exercise number.

Evaluate the function.

$$f(x) = \begin{cases} 8x - 2, & \text{if } x < -4 \\ 3x - 6, & \text{if } x \geq -4 \end{cases}$$

$$g(x) = \begin{cases} -2x + 5, & \text{if } x \leq -3 \\ 7, & \text{if } -3 < x < 1 \\ 4x - 8, & \text{if } x \geq 1 \end{cases}$$

1. $f(-4)$
2. $f(6)$
3. $f(-6)$
4. $f(0)$
5. $f(-3)$
6. $g(0)$
7. $g(-5)$
8. $g(1)$
9. $g(4)$
10. $g(-3)$

Answers

E. -6 N. 12

E. -50 Y. 7

A. -15 I. 8

E. -18 G. 11

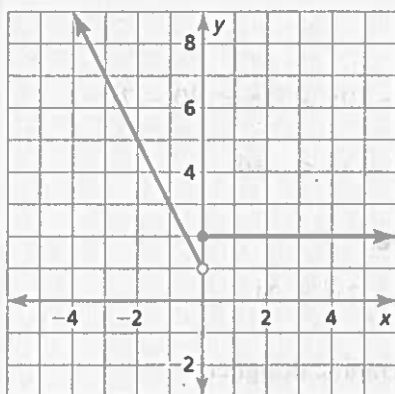
D. -4 G. 15

$$V. f(x) = \begin{cases} -3, & \text{if } x \leq 0 \\ x + 1, & \text{if } x > 0 \end{cases}$$

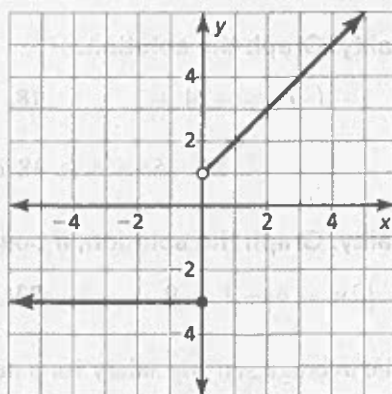
$$G. f(x) = \begin{cases} -2x + 1, & \text{if } x < 0 \\ 2, & \text{if } x \geq 0 \end{cases}$$

Write a piecewise function for the graph.

11.



12.



5	2		3	8	11	6		12	4	10	7	9	1
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Chapter**4****Cumulative Review**

In Exercises 1–5, solve the equation and check your answer.

1. $2 - x = -17$

2. $4\pi + x = 10\pi$

3. $\frac{z - 13}{7} = 0$

4. $2(3r - 6) = -42$

5. $2x + 2(x + 5) = x + 2(x + 5) + 1$

6. The cost to play an online video game is either \$126 if you sign up for a year or \$18 per month.

- After how many months would the cost be the same?
- How many months would you have to play the game to make the yearly subscription a better deal?

In Exercises 7–9, solve the equation. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

7. $y - 10 = y + 3 - 13$

8. $15v - 60 = -3(20 - 5v)$

9. $3(4x - 2) = 4(3x - 1) + x$

In Exercises 10–13, solve the equation. Graph the solution(s), if possible.

10. $|x - 5| = 8$

11. $|9d| = -36$

12. $|5r - 10| = 15$

13. $-3\left|\frac{y - 1}{2}\right| = -12$

In Exercises 14 and 15, write the sentence as an inequality.

14. A number n is at least 7.

15. The number 13 is no more than a number h times 4.

In Exercises 16–20, solve the inequality. Graph the solution.

16. $2 - x \geq 11 - 7$

17. $1 - (-t) > -24 + 3$

18. $7 - 10z + 11z < 20 - 21$

19. $3x + 3 > 24$ and $2x < 22$

20. $5t + 8 \geq 38$ or $6 + 4t \leq -30$

In Exercises 21–23, solve the inequality. Graph the solution, if possible.

21. $|14x - 1| < -23$

22. $|2w - 4| + 1 \geq 9$

23. $|6 + 3x| < 24$

24. At a visual graphics company, the average starting salary for a new graphic designer is \$37,000, but the actual salary could differ from the average by as much as \$2590.

- Write an absolute value inequality to describe this situation.
- Solve the inequality to find the range of starting salaries.

Chapter 4

Cumulative Review (continued)

In Exercises 25–28, determine whether the relation is a function. Explain.

25. $(1, 8), (2, 8), (3, 8), (4, 8), (5, 8)$

26. $(-1, 7), (7, -3), (-3, -5), (-5, -1), (-1, 3)$

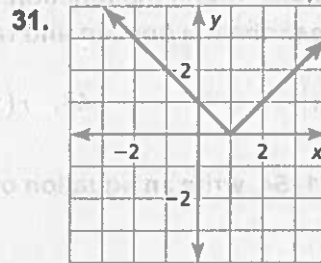
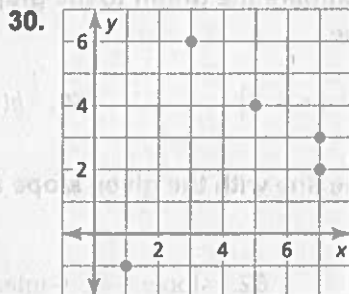
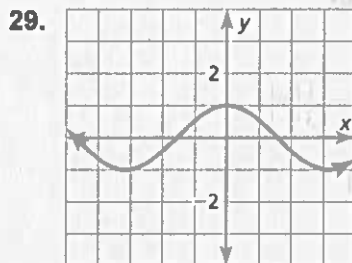
27.

x	0	1	2	0
y	-1	0	1	2

28.

x	-2	0	2	4
y	1	1	1	1

In Exercises 29–31, find the domain and range of the relation and determine whether or not the graph represents a function.



32. The function $y = 2x + 10$ represents the amount of money in your piggy bank y (in dollars) after x weeks.

- Identify the independent and dependent variables.
- Find the domain and range of the function.

In Exercises 33–35, evaluate the function when $x = -3, 0$, and 4 .

33. $f(x) = 2x + 1$

34. $g(x) = -x - 5$

35. $h(x) = 4 - 5x - 6$

In Exercises 36–38, graph the linear function.

36. $f(x) = 2x$

37. $w(x) = -\frac{2}{5}x + 4$

38. $h(x) = -2 - x$

39. The function $f(x) = \frac{1}{3}x + 4$ represents the distance in feet a snail is from a house x hours after it started crawling.

- What is the snail's distance from the house after 9 hours?
- How long will it take the snail to get 13 feet from the house?

In Exercises 40–42, find the x - and y -intercepts of the graph of the linear equation.

Use the intercepts to graph the linear equations. Label the intercepts.

40. $3x + 9y = 36$

41. $4x + 5y = 20$

42. $-x + 9y = 11$

Chapter 4

Cumulative Review (continued)

In Exercises 43–45, find the slope and y -intercept of the graph. Graph the linear equation.

43. $y = x - 3$

44. $y = \frac{3}{4}x$

45. $7x - 3y = 9$

In Exercises 46 and 47, use the graphs of f and g to describe the transformation from the graph of f to the graph of g .

46. $f(x) = 4x - 2$; $g(x) = -4x - 2$

47. $f(x) = 5x + 1$; $g(x) = 5x + 2$

In Exercises 48–50, graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

48. $t(x) = |x| - 3$

49. $r(x) = |x + 2|$

50. $h(x) = \frac{1}{3}|x|$

In Exercises 51–54, write an equation of the line with the given slope and y -intercept.

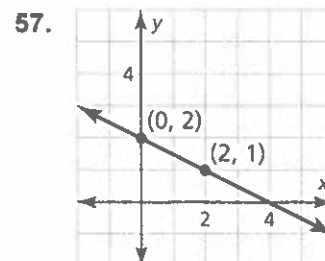
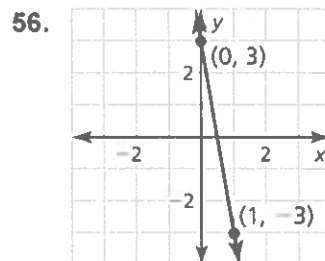
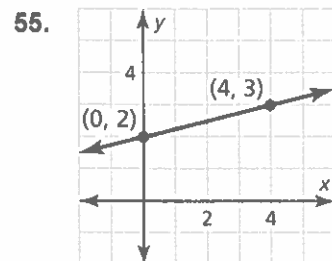
51. slope: 4; y -intercept: 12

52. slope: $-\frac{3}{4}$; y -intercept: -12

53. slope: $\frac{1}{2}$; y -intercept: $-\frac{2}{5}$

54. slope: -3; y -intercept: $\frac{1}{8}$

In Exercises 55–57, write an equation of the line in slope-intercept form.



In Exercises 58–61, write an equation in point-slope form of the line that passes through the given point and has the given slope.

58. $(3, 4)$; $m = 5$

59. $(7, 0)$; $m = -1$

60. $(3, -9)$; $m = \frac{1}{2}$

61. $(-1, -2)$; $m = -\frac{2}{7}$

In Exercises 62–65, write an equation in point-slope form of the line that passes through the given points.

62. $(2, 4)$, $(5, 7)$

63. $(-2, 4)$, $(7, 8)$

64. $(-5, -1)$, $(-3, 7)$

65. $(0, 2)$, $(3, 2)$

Chapter
4**Cumulative Review** (continued)

In Exercises 66–68, write an equation of the line that passes through the given point and is parallel to the given line.

66. $(2, 3); y = 3x - 1$ 67. $(-4, 0); y = \frac{2}{3}x + 1$ 68. $(-2, 7); 2x + y = 6$

In Exercises 69–71, write an equation of the line that passes through the given point and is perpendicular to the given line.

69. $(0, 2); y = -x + 1$ 70. $(1, 2); y = -\frac{3}{4}x - 2$ 71. $(-4, -2); 4x - 2y = 10$

In Exercises 72 and 73, make a scatter plot of the data. Tell whether x and y show a positive, a negative, or no correlation.

72.

x	-2	-2	-1	-1	0	1	2
y	-3	-1	-2	1	0	-1	2

73.

x	-3	-2	-2	0	2	2	4
y	2	0	-2	0	-1	2	-2

In Exercises 74–76, graph the arithmetic sequence.

74. $-4, 0, 4, 8, \dots$ 75. $3, 11, 19, 27, \dots$ 76. $-3, -9, -15, -21, \dots$

In Exercises 77–79, determine whether the sequence is arithmetic. If so, find the common difference.

77. $2, 4, 7, 11, 16, 24, \dots$ 78. $45, 41, 37, 34, \dots$ 79. $7, 13, 19, 25, \dots$

In Exercises 80 and 81, graph the function. Describe the domain and range.

80. $y = \begin{cases} 2x + 1, & \text{if } x \geq -1 \\ 3x - 1, & \text{if } x < -1 \end{cases}$

81. $y = \begin{cases} -\frac{1}{2}x + 2, & \text{if } x < -2 \\ \frac{1}{2}x - 3, & \text{if } x \geq -2 \end{cases}$

Chapter 5

Family Communication Letter (English).....	155
Family Communication Letter (Spanish)	156
Section 5.1	157
Section 5.2	162
Section 5.3	167
Section 5.4	172
Section 5.5	177
Section 5.6	182
Section 5.7	187
Cumulative Review	192